SELF-CONTROL AND EXECUTIVE FUNCTION
IN POSTTRAUMATIC STRESS DISORDER

A dissertation submitted
to Kent State University in partial
fulfillment of the requirements for the
degree of Doctor of Philosophy

by

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August 2010
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ACKNOWLEDGEMENTS

To my husband, Dan, who not only provides love, support, and understanding, but does so as a graduate student himself. Having a partner who understands the process of graduate school has been a great asset to me during my graduate education. I love you and look forward to when you defend!

To my father, Dale, who could not have shown me more love and support throughout my life. You have always been there for me and I cannot thank you enough. Additionally, it is great that we are both Kent State Alumni!

To my mother, Cynthia, who although is no longer physically here, still guides me daily with her spirit and love. I love and miss you mom.

To my mentor, Dr. John Gunstad, for his support and guidance, particularly during the latter part of my graduate education. I am so thankful that you agreed to be my mentor and I have learned so much from you. I especially appreciate your influence in merging my interest in PTSD with neuropsychology!

To my committee members, Dr. Douglas Delahanty, Dr. Jeffrey Ciesla, Dr. Richard Serpe, and Dr. Claire Draucker for not only their time and commitment, but for also helping me to further develop my academic skills.
STUDY 1

Summary

Self-control, often defined as the ability to control one’s thoughts and actions, is one of the most important constructs in psychology. However, the relationship of self-control to clinical disorders has rarely been directly examined. The current study examined whether: 1) self-control would predict posttraumatic stress disorder (PTSD) symptoms in a longitudinal study of 65 inner-city women; and 2) whether PTSD symptoms would predict subsequent levels of self control. Results showed that baseline levels of self-control predicted PTSD symptoms at 3-month follow-up above and beyond other study variables. However, baseline PTSD symptoms did not predict levels of self control at 3-month follow-up. Associations between self-control and other important variables were also examined, including alcohol use, risky sexual behavior, and interpersonal relationships. This research combines clinical and social psychological research to reveal the unidirectional, rather than bidirectional, relationship between PTSD and self-control.
Introduction

Self-control, the ability to control one’s thoughts and actions, is perhaps one of the most important constructs in human psychology. Tangney, Baumeister, and Boone (2004) found that greater levels of self-control were related to higher grade point averages, better relationships and interpersonal skills; secure attachment styles, greater optimal emotional responses to stressful situations and fewer reports of psychopathology; including less binge eating and alcohol abuse, and greater self-esteem among college students. These findings highlight the many aspects of an individual’s environment that can be affected by self-control. Although self-control has been shown to be related to important outcomes, it has been rarely examined in clinical disorders, particularly with regards to PTSD. The current study directly investigates the relationship between self-control and PTSD and to explore the directionality of the relationship.

Self-control is arguably an essential skill for successful functioning in one’s environment. Freud (1930) contended that the ability to inhibit antisocial impulses and conform to social standards of society is the fundamental nature of civilized life. Freud (1957) later suggested that people had a finite amount of mental energy that is used to control these socially inappropriate urges. Although inhibiting inappropriate impulses occurs through self-control, people ultimately exert self-control because they wish to delay gratification for long-term outcomes.
that appear to be in their best interest (Barkley, 1997a; Hayes, 1989; Shallice & Burgess, 1993).

The personality trait of self-control also allows people an opportunity to feel balanced when there is a suboptimal fit between the self, the environment, and one’s goals. People have the ability to improve this fit by altering the self to meet the demands created by the environment (Rothbaum, Weisz & Snyder, 1982). When the environment confines an individual, they are able to modify their behavior to best overcome these obstacles. It is the ability to control and modify one’s behavior that creates one of the most powerful adaptations of the human mind (Tangney, Baumeister, & Boone, 2004).

This adaptation of the mind may allow for individuals to cope with not only daily life and stressors, but also to cope with psychological disorders such as PTSD. For example, greater levels of self-control are related to reduced alcohol and drug use, better interpersonal relationships, and higher self-esteem among college students (Tangney, Baumeister, & Boone, 2004). In turn, less frequent or no drug use, better interpersonal relationships and higher self-esteem can further increase self-control, illustrating the likely reciprocal nature of self-control and psychological symptoms (e.g. Hull & Slone, 2004). Furthermore, individuals with higher levels of self-control may achieve better treatment outcomes if they are receiving psychological treatment. Self-control may allow individuals to obtain more energy, interpersonal, and tangible resources, which can enhance
therapeutic gains. Additionally, self-control enables individuals to work through difficult sessions in therapy to achieve positive long-term outcomes.

Although the relationship between self-control and psychological disorders has not been widely examined in the literature, reduced self-control is related to antisocial personality disorder, substance use disorders, and anger management issues (Tangney, Baumeister, & Boone, 2004). Conversely, too much self-control has been related to disorders such as anorexia and obsessive compulsive disorder (Tangney, Baumeister, & Boone, 2004). Self-control may be especially relevant to PTSD for two primary reasons: (1) self-control is likely needed to regulate PTSD symptoms, such as re-experiencing aspects of the traumatic event and (2) self-control is important for processing emotions and thoughts as part of trauma-focused PTSD. Thus, an individual must exert self-control to cope with symptoms and the negative short-term effects of treatment in order to achieve long-term symptom reduction.

The Limited Nature of Self-Control

The relationship between self-control and PTSD symptoms can be further conceptualized by the strength model of self-regulation proposed by Baumeister, Heatherton, and Tice (1994). The strength model of self-regulation provides a comprehensive theory that explains why self-control may be reduced in individuals who lack resources, even temporarily, for self-control. The strength model of self-regulation (Baumeister, Heatherton, & Tice, 1994) conceptualizes
self-regulation akin to a muscle, where self-regulation can be reduced after exertion, yet strengthened through practice. One of the key assumptions of the model states that similar to muscular strength, self-control strength is finite (Baumeister, Heatherton, & Tice, 1994). The theory also assumes that all self-control behaviors use the same energy resource reservoir (Baumeister, Heatherton, & Tice, 1994). This resource pool refers to personal energy that can be devoted to acts of self-control. Since resources are shared, if individuals use self-control in one area, they have fewer resources to contribute to other self-control demands.

The limited nature of self-control has been experimentally demonstrated as even trivial laboratory tasks can deplete people’s resources for self-control of behavior (Baumeister, Bratslavsky, Muraven, & Tice, 1998). When self-control resources have been expended, ego-depletion occurs (Baumeister, Heatherton, & Tice, 1994). Ego-depletion is a state where individuals no longer have resources to contribute to subsequent self-control behaviors (Baumeister, Heatherton, & Tice, 1994). Research shows that when individuals are in a state of ego-depletion, successive attempts at the self-control of behaviors are more likely to fail (Schmeichel & Baumeister, 2004). This consideration can be especially important as ego-depletion is likely to occur in persons with psychological disorders. Individuals are expected to expend significant amounts of self-control resources to cope with their symptoms and thus, have fewer self-control resources to devote to other areas. For example, individuals affected by
natural disaster may have difficulty completing essential tasks such as rebuilding their home, finding employment, and attending to personal relationships because they exhaust resources coping with psychological symptoms. Thus few, if any, resources are left to devote to long-terms efforts of coping and rebuilding their lives – tasks requiring significant amounts of sustained self-control (Baumeister et al., 1998; Hobfoll, 1991; Norris & Kaniasty, 1996). Applying the strength model of self-control, a bidirectional relationship would be theorized to occur between self-control and PTSD. More specifically, reduced self-control may lead to increased PTSD symptoms or severity, as well as increased PTSD symptoms or severity could result in reduced self-control.

**Relationship between Self-Control and PTSD**

The state of ego-depletion may predict an exacerbation of PTSD symptoms as individuals are required to exert self-control resources to cope with negative emotions, flashbacks, and anxiety symptoms. Heatherton, Baumeister, and Tice (1994) suggest that individuals who are in a state of ego-depletion have fewer self-control resources to devote to other acts of self-control. Thus, if individuals have expended self-control in other areas (e.g. dieting, working extra hours, etc.), then they will be less likely to be able to regulate affect and cope with symptoms of PTSD, consistent with the strength model of self-regulation (Baumeister & Heatherton, 1996). It is anticipated that individuals in a state of ego-depletion would have fewer resources to contribute to managing their symptoms of PTSD and experience an increase in symptoms or severity.
There are also situations where the trauma itself can consume tangible or social resources needed for self-control. It has been proposed that trauma victims become passive and unable to function because the energy resources required to cope with the trauma itself exhaust their ability to regulate emotions (Baumeister et al., 1998; Hobfoll, 1991). The significant energies allocated to emotion regulation results in ego-depletion, leading to further distress and difficult recovery efforts in the aftermath of trauma (Baumeister et al., 1998; Hobfoll, 1991). Thus, coping efforts become increasingly difficult as the resources needed to recover (e.g. safe home, social support) are depleted by the trauma itself (Baumeister et al., 1998; Hobfoll, 1991).

As people experience the loss of various resources in the aftermath of a trauma, the process may lead to a downward spiral as the tangible resources needed to cope with the trauma are also depleted (Baumeister et al. 1998; Hobfoll, 1991). For example, individuals surviving a natural disaster may have lost their home, belongings, and perhaps even their place of employment. These resources could provide safety, social support, and financial resources for individuals. Access to these resources would allow them to devote more energy resources to self-control and long-term planning. But as individuals attempt to recover from extensive loss, they are less able to exert self-control behaviors when they have been stretched beyond their coping resources. Furthermore, striving for long-term goals becomes increasingly difficult as individuals do not have the tangible and energy resources to cope with current stressors. Thus, on
various levels, research and theory suggests that reduced self-control may be related to more severe PTSD symptoms.

Although it is expected that reduced self-control will predict increased PTSD symptoms; is also likely that PTSD symptoms will reduce the available levels of self-control. PTSD may deplete self-control resources by experiencing or avoiding emotional distress, coping with psychological symptoms, or losing resources through the traumatic event that are needed for recovery. The emotional distress of many psychological disorders is known to deplete self-control resources and reduce self-control with regards to food and alcohol consumption (Baumeister et al., 1998). Emotional distress adversely impacts delay of gratification in non-depressed adults, as those in an experimentally-induced sad or angry mood were less able to cooperate in a social dilemma situation than those who experienced a neutral or happy mood (Knapp & Clark, 1991). Emotional distress can also decrease self-control by producing stressful outcomes that further limit the individual’s ability to regulate their behavior (Tangney, Baumeister, & Boone, 2004). Baumeister and Heatherton (1996) found individuals under stress and with negative emotional states became more irritable and emotional. They were also more likely to increase behaviors such as smoking, abusing drugs/alcohol, and overeating when using self-control resources to regulate affect. These changes were attributed to ego-depletion, as it was believed that coping with stress and negative emotions would consume self-control resources (Baumeister & Heatherton, 1996). In turn, these behaviors
can lead to other comorbid conditions (e.g. substance use) likely to further impair the ability to regulate psychological symptoms (Hull & Slone, 2004).

Another way that PTSD may negatively impact self-control resources is through the suppression or avoidance of emotions. These behaviors are particularly common in persons with PTSD, as symptoms of avoidance comprise one of the three diagnostic symptom clusters (APA, 2000). Baumeister et al. (1998) showed that participants who were asked to suppress emotion while watching a movie performed worse on an anagram test than those taking it under standard instructions. In extending this finding to persons with PTSD, it appears that attempts to suppress or control thoughts and emotions may quickly result in ego-depletion. The state of ego-depletion weakens individuals’ self-control resources and makes future attempts of self-control, such as emotion regulation and management of psychological symptoms, less likely to be successful (Schmeichel & Baumeister, 2004).

Ego-depletion is common in persons with psychological disorders, as persons must engage volitional efforts to cope with their affect (Gross, 1998b). In this way, PTSD may serve as a model as to how the rapid, widespread loss of resources and a person’s ability to regulate their behavior can affect subsequent psychological symptoms and in turn, affect self-control. Even individuals who may otherwise be capable of sufficient self-control behaviors are often unable to find available energy resources to devote to self-control behaviors when coping
with psychological distress (Baumeister & Heatherton, 1996). The exhausting nature of managing negative affect and psychological disorders further shows the limits to self-control capacity for individuals coping with negative emotions. Expending valuable energy resources leaves individuals without the resources to contribute to long-term goals and self-control behaviors.

The current study was designed to explore the relationship between self-control and PTSD symptoms. It was hypothesized that baseline levels of self-control will predict PTSD symptom levels at 3-month follow-up, as individuals with reduced self-control may have fewer personal resources for coping and thus have increased PTSD symptoms. The hypothesis is consistent with research and theory suggesting that individuals with greater self-control would have more energy resources to cope with negative affect and PTSD symptoms and thus be less impaired by these symptoms (Tangney, Baumeister, & Boone, 2004). It was also hypothesized that baseline PTSD symptoms would predict self-control at 3-month follow-up. This prediction was based on the notion that individuals with PTSD use energy resources to cope with their symptoms and in turn, have fewer self-control resources to devote to other circumstances (Baumeister et al., 1998; Hobfoll, 1991). Additionally, the associations between self-control and alcohol use, risky sexual behavior, and interpersonal relationships were examined to identify possible mechanisms through which self-control relates to PTSD symptoms.
Methods

Participants. Sixty-five inner-city women recruited from two obstetric/gynecology clinics in Akron, Ohio comprised the sample for study 1. Recruitment was conducted at the women’s clinic at Akron City Hospital, part of Summa Health System, and Planned Parenthood of Akron. The study and use of participants was approved by the institutional review boards at Kent State University and Summa Health System.

Participants were 18-39 years of age and were selected for the study if they endorsed a history of physical, sexual, or emotional abuse and responded to subsequent screening items in a way that suggested probable PTSD. Participants who met criteria were, on average, 24.75 (SD = 5.95) years of age. Sixty-two percent of participants were unemployed and 55% had annual household incomes under $10,000. Thirty percent of the sample had some high school education, with an additional 32% earning a high school diploma. The majority of the sample was single and had never been married, consisting of 81% of the respondents. African Americans comprised 47% of the sample, and European Americans comprised 39%. The remaining respondents were Hispanic, Asian, or of multi-ethnic backgrounds.

Procedures. Women waiting for their appointment in the two respective clinics were approached by a trained graduate student in clinical psychology. Women were screened for a history of interpersonal violence/trauma. If women
endorsed a history of interpersonal violence/trauma they were taken to a private room within the clinic to continue screening for eligibility. The screening included 3 questions modified from the Abuse Assessment Screen (AAS; Soeken et al., 1998). When women endorsed one of the 3 abuse screen items, they were then asked 4 questions from the Primary Care PTSD Screen (PC-PTSD; Prins et al., 2003), which measures probable or partial PTSD. The 4 questions consist of one question for each re-experiencing, avoidance, emotional numbing, and hyperarousal symptom of PTSD. If women endorsed at least 2 of the 4 questions then they were asked a question assessing functional impairment. If women endorsed an impairment score of 3 or higher (scale ranges from 1-5), then they were considered likely to have a diagnosis of PTSD. These women were considered to have met selection criteria and were then asked about their interest in participating in the study. If the woman expressed interest in participating, then informed consent was obtained and the questionnaire was administered in a structured interview format.

The questionnaire administration took approximately 45 minutes per participant. Participants were paid $10 for completion of the baseline questionnaire. Women were then contacted via telephone 3 months later for a follow-up assessment interview. Follow-up assessment interviews were conducted at the aforementioned women’s health clinics, a public location, or a participant’s home, whichever was most convenient for the participant. Upon
completion of the 3-month follow-up, women were given an additional $30 and thanked for their participation in the study.

Measures. The current study used selected measures and constructs from a pilot study conducted after data collection for the Women’s Health Empowerment Project. For the current study, demographics, PTSD, and self-control information collected at baseline and at the 3-month follow-up interview will provide data for analysis. All measures were administered at both assessment time points.

Demographic questionnaire. A self-report demographic questionnaire was used to collect information relating to age, race, education, employment status, marital status, and income.

PTSD. Post-Traumatic Symptom Scale- Interview version (PSS-I; Foa, Riggs, Dancu & Rothbaum, 1993). The PSS-I is a frequently used 17-item scale that contains items which correspond to PTSD symptom criteria found in the Diagnostic and Statistical Manual of Mental Disorders, fourth edition, revised (DSM-IV-TR; American Psychiatric Association, 2000). Each of the 17 items on the PSS-I corresponds to a symptom of PTSD listed in the DSM-IV-TR criteria for PTSD. The PSS-I is the interview version of the posttraumatic stress scale - self report version (PSS-SR; Foa, Riggs, Dancu & Rothbaum, 1993). Each symptom criterion is rated in terms of frequency or severity on a 0 (not at all) to 3 (very
much) scale. Scores on the PSS-I range from 0-51. The Cronbach’s alpha for the PSS-I ranges from $\alpha = .65-.86$ (Foa & Tonlin, 2000).

**Self-Control. Brief Self-Control Scale (BSCS; Tangney, Baumeister & Boone, 2004).** The BSCS is a recently developed self-report scale assessing individual differences concerning the construct of trait self-control. The brief version of the SCS was used in this study. Thirteen items are rated on a Likert scale anchored from 1 (not at all like me) to 5 (very much like me). Internal consistency for this measure is approximately $\alpha = .85$ and test-retest reliability was $r = .87$ (Tangney, Baumeister, & Boone, 2004). The brief version correlates approximately $r = .93$ with the full scale in developmental studies (Tangney, Baumeister, & Boone, 2004).

**Resource Loss. Conservation of Resources-Evaluation (COR-E; Hobfoll & Lilly, 1993).** Forty-five resources relevant for inner-city women’s lives were selected from the full 74-item measure. Resource item categories included: material resources (i.e. money for transportation), energy resources (i.e. financial assets), non-familial interpersonal resources (i.e. loyalty of friends), family resources (i.e. intimacy with spouse/partner), and work resources (i.e. necessary tools for work). Participants were asked to report loss experienced in the past month on each item. The loss variables were rated on a scale from 1 (no loss or threat of loss) to 3 (a great deal of loss).
**Perceived Social Support. Social Provisions Scale (Cutrona, C. E. & Russell, D., 1987).** The Social Provisions Scale is a 24-item scale assessing domains of perceived social support. The scale consists of 4 items from the following categories: attachment, reassurance of worth, reliable alliance, social integration, opportunity for nurturance, and guidance. Half of the items describe a presence of social support, whereas the other half describes the absence of social support. The absence of social support items are reverse coded, yielding a score where higher scores are related to increased satisfaction with social support. Of the 24-items, 10-items selected as most relevant for the sample (5 presence and 5 absence) were administered to participants in the study.

**Risky Sexual Behavior.** Risky sexual behavior was assessed in two primary ways. The first measure of risky sexual behavior included 3 items assessing how many times a person engaged in vaginal, oral, or anal sex without a condom in the past 2 months. The second measure of risky sexual behavior consisted of 2 questions asking participants to indicate the number of times in the past 2 months they used alcohol or drugs prior to engaging in sexual activity.

**Alcohol and Drug use.** Alcohol and drug use was assessed using 3 questions asking the participant to (1) indicate the number of times they consumed at least 1 drink of alcohol in the past 2 months; (2) indicate the number of times they consumed 4 or more drinks on one occasion in the past 2
months; and (3) indicate the number of times they used any drugs (other than prescriptions taken as prescribed) in the past 2 months.

**Results**

The dependent variables, PTSD and self-control, were calculated based on the scoring procedures for the PSS-I (Foa, Riggs, Dancu, & Rothbaum, 1993) and BSCS (Tangney, Baumeister, & Boone, 2004), respectively. Means and standard deviations can be found in Table 1-1. Results elucidate the directionality of the relationship between self-control and PTSD symptoms.

**Table 1-1: Means and Standard Deviations for Study Variables**

<table>
<thead>
<tr>
<th></th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline PTSD</td>
<td>14.49</td>
<td>11.97</td>
</tr>
<tr>
<td>3-month PTSD</td>
<td>12.63</td>
<td>10.34</td>
</tr>
<tr>
<td>Baseline Self-control</td>
<td>24.23</td>
<td>10.98</td>
</tr>
<tr>
<td>3-month Self-control</td>
<td>26.63</td>
<td>10.85</td>
</tr>
<tr>
<td>Education</td>
<td>2.13</td>
<td>0.99</td>
</tr>
</tbody>
</table>

*Note. Education: eighth grade or less = 0; some high school = 1; high school graduate = 2; some college = 3; college graduate = 4*

Hierarchical multiple linear regression was used to test the hypothesis that self-control would predict later PTSD symptoms and that PTSD symptoms would predict later self-control. Variables in the equation met the following assumptions for the analysis: variables were normally distributed, were not multicollinear, error
scores were homoscedastic, and linear relationships existed among variables. A power analysis on this data indicated a large effect size for the relationship between self-control and PTSD symptoms in 65 participants ($f^2=.81$) (Erdfelder, Faul, & Buchner, 1996).

Completer Analyses. Participants who completed both baseline and follow-up assessments were compared with participants who completed only the baseline assessment as to determine the generalizability of the final sample. Of the 79 participants who enrolled in the study, 65 participants completed both the baseline and follow-up assessment, resulting in a retention rate of 82%.

Completers and non-completers were very similar and did not differ on age $t(78) = .07, p>.05$, ns; education $t(78) = .06, p>.05$, ns; annual income $t(78) = .08, p>.05$, ns; race $t(78) = 2.12, p>.05$, ns; reported baseline self-control $t(78) = .35, p>.05$, ns; or baseline PTSD symptoms $t(78) = 3.05, p>.05$, ns.

Self-control as a predictor of PTSD symptoms. Hierarchical multiple linear regression was used in this study to determine if baseline self-control predicts PTSD symptoms at 3-month follow-up. Age, race, education, and income were not significantly correlated with the dependent variable and were thus not used as control variables in the equation. The first step of the hierarchical multiple linear regression analysis included PTSD symptoms at the baseline assessment as a control variable. Self-control measured at baseline was entered as the predictor in the second step.
Results showed that reported self-control strength at baseline predicted PTSD symptoms at 3-month follow-up above and beyond PTSD symptoms at baseline (see Table 1-2). The model explained 49% of the variance in predicting PTSD symptoms at 3-months (\(R^2 = .49\), adjusted \(R^2 = .47\); \(F (2, 59) = 28.79, p<.001\)). Further inspection of the model showed that individuals with higher reported self-control had fewer PTSD symptoms (\(\beta = -.24, p<.05\)) than individuals with lower reported self-control. These results indicate that reported self-control inversely independently predicted future PTSD symptoms, as higher self-control was related to lower levels of PTSD symptoms.

*Table 1-2. Hierarchical Regression Analyses Predicting PTSD Symptoms at 3-month follow-up (N=62)*

<table>
<thead>
<tr>
<th>Predictor</th>
<th>B</th>
<th>SE B</th>
<th>(\beta)</th>
<th>(R)</th>
<th>(R^2)</th>
<th>(\Delta R^2)</th>
<th>(F) change</th>
<th>df</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline PTSD</td>
<td>.63</td>
<td>.09</td>
<td>.67***</td>
<td>.45</td>
<td>.45</td>
<td>48.20***</td>
<td>1, 60</td>
<td></td>
</tr>
<tr>
<td>Step 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline PTSD</td>
<td>.55</td>
<td>.09</td>
<td>.58***</td>
<td>.49</td>
<td>.05</td>
<td>5.65</td>
<td>1, 59</td>
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<tr>
<td>Baseline Self-control</td>
<td>-.23</td>
<td>.10</td>
<td>-.27*</td>
<td>-.24</td>
<td>-.24</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note. *p<.05, **p<.01, ***p<.001*

*PTSD symptoms as a predictor of self-control.* Hierarchical multiple linear regression was then used to determine whether baseline PTSD symptoms
predict self-control at 3-month follow-up. Age, race, and income were not significantly correlated with the dependent variable and were not used as control variables in the model. Level of education, however, was related to the dependent variable ($r = .24, p < .05$) and was entered used as a control variable. The first step of the linear multiple regression analysis included level of education and self-reported self-control at the baseline assessment to control for earlier levels of reported self-control. The second step contained reported PTSD symptoms at baseline, as the main predictor in the equation. Results showed that the overall model predicted future self-control $F (3, 60) = 45.62, p < .001$; however, PTSD symptoms at baseline did not predict self-control strength at 3-month follow-up ($\beta = -.07, p > .05$; see Table 1-3) above and beyond baseline reports of self-control and education. Thus, results showed a unidirectional relationship where self-control predicted subsequent PTSD symptoms, but that PTSD symptoms did not predict future self-control.
Table 1-3. Hierarchical Regression Analyses Predicting Self-Control at 3-month follow-up (N=64)

<table>
<thead>
<tr>
<th>Predictor</th>
<th>B</th>
<th>SE B</th>
<th>β</th>
<th>R</th>
<th>R²</th>
<th>ΔR²</th>
<th>F change</th>
<th>df</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline Self-</td>
<td>.78</td>
<td>.08</td>
<td>.79</td>
<td>.69</td>
<td></td>
<td>.69</td>
<td>68.34***</td>
<td>2, 61</td>
</tr>
<tr>
<td>Control</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Level of Education</td>
<td>.42</td>
<td>.82</td>
<td>.04</td>
<td>.83</td>
<td>.70</td>
<td>.00</td>
<td>.74</td>
<td>1, 60</td>
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<tr>
<td>Step 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline Self-</td>
<td>.80</td>
<td>.08</td>
<td>.81</td>
<td>.83</td>
<td>.70</td>
<td>.00</td>
<td>.74</td>
<td>1, 60</td>
</tr>
<tr>
<td>Control</td>
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</tr>
<tr>
<td>Level of Education</td>
<td>.51</td>
<td>.82</td>
<td>.05</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline PTSD</td>
<td>-.07</td>
<td>.08</td>
<td>-.07</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. *p<.05, **p<.01, ***p<.001

**Correlation between Self-control and Self-report Measures.** A correlation table exploring the associations between self-control and social support, resource loss, alcohol and drug use and risky sexual behavior (see Table 1-4) was generated to determine possible mechanisms for the relationship between self-control and PTSD that may be explored in future research.
Table 1-4. Bivariate Correlations between Baseline Self-control and Alcohol/drug use, Resource Loss, Social Support, and Risky Sexual Activity (N=79).

<table>
<thead>
<tr>
<th>Self-Control</th>
<th>$r$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social Support</td>
<td>.34**</td>
</tr>
<tr>
<td>Resource Loss</td>
<td>-.07</td>
</tr>
<tr>
<td>Alcohol Use</td>
<td>-.28*</td>
</tr>
<tr>
<td>Drug Use</td>
<td>-.13</td>
</tr>
<tr>
<td>Risky Sexual Behavior</td>
<td>-.25*</td>
</tr>
</tbody>
</table>

*Note.* *p*<.05, **p*<.01, ***p*<.001

Bivariate Pearson correlations showed that baseline reports of self-control were significantly related to perceived social support, alcohol use, and risky sexual behavior. Specifically, self-control was positively correlated with perceived social support and negatively correlated with alcohol use and risky sexual behavior. The bivariate correlations between baseline reports of self-control and both resource loss and drug use were not found to be significant in the analysis. The findings indicate that baseline reports of self-control are related to certain risk or protective factors, but not to all of the explored factors in this analysis.

**Discussion**

The findings of the current study reveal that self-control predicts later PTSD symptoms, though PTSD symptoms were not found to predict later self-control. This pattern of results partially confirms our hypotheses. The current study theorized that the relationship between self-control and PTSD would be
reciprocal in nature, consistent with notions set forth by the theory of ego-depletion (Baumeister, Bratslavsky, Muraven, & Tice, 1998; Baumeister, Heatherton, & Tice, 1994; Muraven & Baumeister, 2000). However, the relationship appears to be unidirectional in nature, with self-control playing an important role in the longitudinal nature of PTSD symptoms.

The role self-control plays in predicting later PTSD symptoms may indeed result from ego-depletion, as management of PTSD symptoms would be expected to require substantial self-control. It would be expected that individuals who have fewer self-control resources have fewer resources to devote to coping with the symptoms of PTSD (e.g. Baumeister & Heatherton, 1996; Schmeichel & Baumeister, 2004), thus resulting in increased symptoms. Conversely, individuals with greater self-control resources have more resources to contribute towards managing their PTSD symptoms, thus resulting in decreased symptoms. Self-control may also predict PTSD symptoms over time because the trauma itself exhausts resources that could have been used for later management of PTSD symptoms (Baumeister et al., 1998; Hobfoll, 1991). Traumatic events can disrupt a stable home environment, social support network, or healthy coping strategies (Hobfoll, 1991), which support and maintain self-control. As a result, trauma-exposed individuals may have inadequate self-control to cope with their PTSD symptoms over an extended period of time. Furthermore, although the current sample was not seeking treatment, it is possible that individuals who have fewer
self-control resources would also be less likely to persist through treatment and thus fail to achieve self-control benefits.

The lack of support for the predictive nature of PTSD symptoms on future self-control was unexpected and contrary to predictions. It was hypothesized that if an individual is attempting to manage their symptoms of PTSD, they would have less energy to devote to self-control efforts and thus experience reductions in self-control. There are several possible explanations for this pattern of findings. One possibility is the important difference between state and trait levels of self-control. The measure of self-control used in the study measures trait self-control, asking a participant to rate how the statement generally reflects how they view themselves. Perhaps PTSD symptoms would better predict state levels of self-control, tapping into a construct that would fluctuate with changes in PTSD symptoms. Relatedly, self-control was assessed solely using self-report instruments. It is possible that individuals may not be able to accurately assess their self-control abilities and that a behaviorally-observed self-control task would have produced different findings. Another explanation may be found at the theoretical level in that energy devoted to self-control remains relatively unaffected by PTSD symptoms, or that these two domains do not share the same resource (as has been suggested by Baumeister and colleagues 1994; 1998; 2000; 2004). The measurement and theoretical considerations of self-control may account for the lack of support found for PTSD symptoms predicting
future reports of self-control. Future work is needed in other samples to clarify these possible explanations.

The unidirectional nature of the relationship between self-control and subsequent symptoms of PTSD suggests a promising way to reduce PTSD symptoms in individuals’ lives. Improvements in self-control would appear to reduce long-term PTSD symptoms. Muraven, Baumeister, and Tice (1999) showed self-control can be strengthened, or enhanced, through practice. If self-control is unaffected by PTSD symptoms and can be enhanced (Muraven, Baumesister, & Tice, 1999), then self-control may serve as a protective factor against future PTSD symptoms.

The current study has several strengths that further existing knowledge related to both self-control theory and PTSD. An extensive literature demonstrates self-control is related to a number of positive outcomes such as lower psychopathology, better interpersonal relationships, and reduced alcohol and drug use in other populations (Khantzian, 1990; Miller & Brown, 1991; Tangney, Baumeister, & Boone, 2004). However, the relationship between self-control and PTSD symptoms had not been previously examined. The findings of the current study are innovative as they identify self-control as a modifiable factor that affects the future course of PTSD. However, there are numerous questions that remain to be answered. A better understanding of the mechanisms for the association between self-control and future PTSD symptoms will clarify strategies
for optimal intervention. Self-control has been shown to be strengthened in an experimental manipulation (Muraven, Baumeister, & Tice, 1999), but strategies to improve self-control in clinical populations have not been established. Future research can contribute to this area by identifying ways to strengthen self-control in clinical settings.

Another strength of the current study is that the sample consists primarily of lower socioeconomic status women of both European American and African American descent, who comprise an understudied and underserved population. Additionally, this sample exhibited a wide range of PTSD symptom severity and reported self-control, which allows for variability in the measured constructs. Furthermore, findings from the current study provided additional support for the association between self-control and behaviors such as alcohol consumption and risky sexual behavior, which can highlight possible mediators for other studies examining self-control and psychopathology.

Limitations of the current study include a relatively small sample size, eliminating the opportunity for advanced statistical techniques such as structural equation modeling (SEM). Similarly, all data to be used for these analyses were collected as part of a previous study, thus precluding opportunity to examine other variables of interest. However, given that no previous study has examined the possible association between self-control and PTSD symptoms, use of
archival data may be more appropriate to minimize financial risk and participant burden.

Finding that self-control predicts future PTSD symptoms helps bridge clinical and social psychological research. Clinical research has explored predictors of PTSD (for an extensive review of the literature see Ozer, Best, Lipsey, & Weiss, 2003) and have noted impairments in areas consistent with self-control deficits (e.g. Dileo, Brewer, Hopwood, Anderson, & Creamer, 2008; Najavits, Weiss, & Liese, 1996). Social psychology research has shown that self-control is related to less psychopathology, higher perceived social support, and reduced alcohol and drug use (Tangney, Baumeister, & Boone, 2004) – outcomes that appear to negatively predict PTSD symptoms. Thus, this study combines the clinical and social psychology literature to explicitly study the relationship between self-control and PTSD symptoms. Further integrating these research areas will help answer critical questions that advance the psychological literature by addressing both clinical and experimental research.
STUDY 2

Summary

Study two determined whether executive function, which involves many abilities critical for self-control, changes during the course of trauma-focused treatment. Existing cross-sectional research shows inconsistent findings regarding the possible association between posttraumatic stress disorder (PTSD) and executive functioning. The current study proposed a longitudinal design to determine if executive function improved among individuals receiving trauma-focused treatment. Self-report and neuropsychological performance was assessed at baseline and at a 3-month follow-up. Results indicate that one measure of executive function, the Stroop color-word score, changed over the course of trauma-focused treatment. PTSD symptoms, as well other psychological symptoms, also improved throughout the course of treatment. Although levels of self-control did not change over the course of treatment, it was related to a measure of executive function. Findings of this study help elucidate the relationship among self-control, executive functioning, and PTSD.
Introduction

PTSD is a psychological disorder resulting from exposure to a traumatic event, where the person also evidences re-experiencing, avoidance, and hyperarousal symptoms related to the trauma (APA, 2000). Although numerous studies have examined anxiety and mood symptoms associated with PTSD; few studies have examined neuropsychological aspects of this disorder (Wolfe & Charney, 1991). Clinical observations and preliminary studies suggest that individuals exposed to traumatic experiences and those with subsequent PTSD often show disruptions in executive function abilities (Sutker, Winstead, Galina & Allain, 1991; Vasterling, Brailey, Constans, & Sutker, 1998; Wolfe, 1994).

Executive function abilities allow individuals to engage in purposive or autonomous behavior (Lezak, Howieson, & Loring, 2004, p. 35). When executive functions are impaired, individuals may be unable to work independently, practice self-care, or maintain interpersonal relationships (Lezak, Howieson, & Loring, 2004, p. 35).

The frontal lobes mediate most aspects of executive function, including abilities such as inhibition, self-control, executing plans, and forming judgments (Fuster, 1997; Knight, Grabowecky, & Scabini, 1995; Oscar-Berman, & Bardenhagen, 1998; Tulving, Kapur, Craik, Moscovitch, & Houle, 1994). In addition to these cognitive abilities, the frontal lobes also assist in the regulation of impulses, affect, and mood stability (Fuster, 1997). These abilities are also frequently problematic for individuals with PTSD and suggest frontal lobe
dysfunction in the symptoms of this disorder (Cloitre, Stovall-McClough, & Levitt, 2004).

PTSD has been theorized to impact executive function through the frontal-subcortical pathways associated with anxiety and stress (Arnsten, 1998; Davidson & Irwin, 1999; Kaufman et al., 2000; Krystal, Bennett, Bremner, Southwick & Charney, 1995; Mizoguchi et al., 2000). Impairment of these frontal-subcortical pathways has been demonstrated through the use of functional magnetic resonance imaging (fMRI) studies examining individuals with PTSD (Bremner, Southwick, & Charney, 1999; Lanius et al., 2001; Liberzon, Abelson, Flagel, Raz, & Young 1999; Shin, McNally, & Kosslyn, 1999). Similarly, decreased frontal gray matter volume was found among individuals who experienced interpersonal violence as compared to non-victimized controls (Fennema-Notestine, Stein, Kennedy, Archibald, & Jernigan, 2002). These findings are consistent with case studies of patients who have documented frontal-subcortical pathology (Damasio & Anderson, 1993; Shimamura, Janowsky, & Squire, 1991; Stuss, 1991). Impairments related to frontal-subcortical pathways have prompted subsequent research assessing factors contributing to executive function deficits. Stuss and Benson (1986) found that disorders involving arousal and frontal lobe dysfunction were related to difficulties such as monitoring, anticipating information, and preparing to respond.
An important finding within the above studies is the relationship among PTSD symptoms, frontal lobe dysfunction, and impaired performance on executive function tests.

Shin et al. (1999) found persons with PTSD had decreased neural activity in the medial prefrontal regions, brain centers that are critical for emotion regulation and modulation. Furthermore, in a study specifically examining executive function and emotional processing in Iraq War veterans with PTSD, activation of ventral emotional processing areas by combat-related stimuli was associated with greater severity of PTSD symptoms (Morey, Petty, Cooper, LaBar, & McCarthy, 2008). The study also found that activation in frontal brain regions used for executive tasks corresponded to PTSD symptom severity. These findings support the current hypothesis that executive function will improve as PTSD symptoms decrease, most likely due to improved function in frontal brain regions.

In addition to functional neuroimaging studies, neuropsychological studies also show impaired executive function individuals with PTSD. Impairments in executive function are found in a wide range of PTSD patient groups, including military veterans and women with rape-related PTSD (Gil, Caley, Greenberg, Kuglemass, & Lerner, 1990; Sutker et al., 1991; Uddo, Vasterling, Brailey, & Sutker 1993; Bremner et al., 1993, 1995; Beckham, Crawford, & Feldman, 1998;

Recent studies suggest that some aspects of executive function are more influenced by PTSD than others. For example, women affected by interpersonal violence (IPV) had decreased performance on tasks of working memory and response inhibition as compared to no-trauma controls (Stein, Kennedy & Twamley, 2002). Specifically, Stein et al. (2002) found that individuals with PTSD took significantly longer to complete a set shifting task (Trail Making Test B) than those in the non-PTSD groups. Koso and Hansen (2006) found that Bosnian war veterans with PTSD showed slower performance on a set shifting measure and increased mistakes on a sustained attention test. Koenen et al. (2001) showed that when performance deficits did exist among individuals with PTSD, they were shown on select executive functions such as delayed response, object alternation, and delayed nonmatching-to-sample tasks, suggesting that deficits may exist, but may be selective and inconsistent among different samples and trauma experiences.

Importantly, a recent study showed that impaired executive function is associated with poorer prognosis and outcomes in psychological treatment (Twamley, Hami, & Stein, 2004). One explanation for this finding is that executive function mediates self-control in persons with PTSD. Carver & Scheier (1981; 1982) assert that if an individual is to exert self-control then several abilities are
necessary. An individual must decide on a long-term goal, recognize steps and barriers to achieving the goals, and resist temptations that distract from the goal (Carver & Scheier, 1981; 1982). Thus, executive function abilities such as reasoning, planning, problem-solving, and impulse control are all tasks required for self-control and achieving long-term goals. Since no current study has directly examined the relationship between self-control and executive function, an association can be predicted based on the idea that executive function tasks are at least partly responsible for the execution of self-control behaviors. If executive function is poorer in individuals with PTSD it would be expected that self-control would be negatively impacted, as reasoning, planning, problem-solving, and inhibition abilities would also be impaired. Thus, it was predicted that executive function will improve over the course of trauma-focused treatment. Additionally, it was hypothesized that PTSD and other psychological symptoms will also improve during treatment.

Methods

Participants. The current study included 32 women being treated for PTSD at the Center for the Treatment and Study of Traumatic Stress (CTSTS), part of Summa Health System. Participants met diagnostic criteria for PTSD as assessed with the Structured Clinical Interview for the DSM-IV (SCID; First, Spitzer, Gibbon, & Williams, 2002) from a traumatic event, where head injury or loss of consciousness (LOC) for longer than 10 minutes was not experienced. Participants who had experienced trauma-related LOC were included so long as
the total time of LOC was not greater than 10 minutes. Participants were aged 21-65, as to include adults in an age range less susceptible to cognitive decline and deterioration. The study and use of participants was approved by the institutional review boards at Kent State University and Summa Health System.

Participants were 32 English-speaking females who received PTSD-specific treatment at the CTSTS. Thirty-two women comprised the overall sample; however, 20 of these 32 women participated in the follow-up study (the remaining 12 were invited to participate in a baseline assessment only study following the same baseline procedures). Of the 20 women who participated in the follow-up study, 15 of the 20 had complete data at both time points. Overall, of 39 participants eligible for the study, 32 accepted, 0 declined, 2 did not meet study criteria, and 5 were referred out of the clinic for more clinically appropriate services.

A summary of the complete sample’s demographic characteristics can be found in Table 2-1. The age range for the complete sample of 32 participants was 21 to 61 (M=40.9, SD=11.87). All 32 participants met diagnostic criteria for PTSD using the SCID. The average number of traumas reported on the THQ at baseline by this sample is 9. The index traumas (trauma the individual is primarily receiving treatment for) reported by this sample: 11 (34%) childhood physical or sexual abuse, 5 (16%) rape, 3 (.09%) domestic violence, 3 (.09%)
robbery, 3 (.09%) witnessed death, 2 (.06%) motor vehicle accidents, and 5 (16%) other (e.g. abduction, medical emergency).

Demographic characteristics for the follow-up sample are presented in Table 2-2. The age range for the follow-up sample was also 21 to 61 (M=41.7; SD=12.03). All 20 participants met diagnostic criteria for PTSD using the SCID. The average number of traumas reported on the THQ at baseline by this sample is also 9. The index traumas (trauma the individual is primarily receiving treatment for) reported by this sample: 8 (40%) childhood physical or sexual abuse, 3 (15%) rape, 2 (10%) domestic violence, 3 (15%) robbery, 3 (15%) witnessed death, and 1 (.05%) other.
<table>
<thead>
<tr>
<th>Table 2-1: Demographic Characteristics for Complete Sample (n=32).</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Race</strong></td>
</tr>
<tr>
<td>European American 24 75</td>
</tr>
<tr>
<td>African American 4 12.5</td>
</tr>
<tr>
<td>Latino 2 6.3</td>
</tr>
<tr>
<td>Biracial 2 6.3</td>
</tr>
<tr>
<td><strong>Marital Status</strong></td>
</tr>
<tr>
<td>Married/equivalent 7 21.9</td>
</tr>
<tr>
<td>Divorced 8 25.0</td>
</tr>
<tr>
<td>Separated 2 6.3</td>
</tr>
<tr>
<td>Single/never married 15 46.9</td>
</tr>
<tr>
<td><strong>Highest Education Obtained</strong></td>
</tr>
<tr>
<td>Eighth grade or less 1 3.1</td>
</tr>
<tr>
<td>Some high school 2 6.3</td>
</tr>
<tr>
<td>High school graduate 3 9.4</td>
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<tr>
<td>Some college 11 34.4</td>
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<tr>
<td>College graduate 13 40.6</td>
</tr>
<tr>
<td>Graduate/professional 2 6.3</td>
</tr>
<tr>
<td><strong>Employed</strong></td>
</tr>
<tr>
<td>Yes 15 46.9</td>
</tr>
<tr>
<td>No 17 53.1</td>
</tr>
<tr>
<td><strong>Income</strong></td>
</tr>
<tr>
<td>Less than $10K 9 28.1</td>
</tr>
<tr>
<td>$10,001 - $25K 9 28.1</td>
</tr>
<tr>
<td>$25,001 - $75K 9 28.1</td>
</tr>
<tr>
<td>$75,001 - $100K+ 5 25.3</td>
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</tbody>
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Table 2-2. Demographic Characteristics for Follow-up Sample (n=20)

<table>
<thead>
<tr>
<th></th>
<th>n</th>
<th>%</th>
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<tr>
<td><strong>Race</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>European American</td>
<td>13</td>
<td>65.0</td>
</tr>
<tr>
<td>African American</td>
<td>4</td>
<td>20.0</td>
</tr>
<tr>
<td>Latino</td>
<td>1</td>
<td>5.0</td>
</tr>
<tr>
<td>Biracial</td>
<td>2</td>
<td>10.0</td>
</tr>
<tr>
<td><strong>Marital Status</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married/equivalent</td>
<td>5</td>
<td>25.0</td>
</tr>
<tr>
<td>Divorced</td>
<td>5</td>
<td>25.0</td>
</tr>
<tr>
<td>Separated</td>
<td>2</td>
<td>10.0</td>
</tr>
<tr>
<td>Single/never married</td>
<td>8</td>
<td>40.0</td>
</tr>
<tr>
<td><strong>Highest Education Obtained</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eighth grade or less</td>
<td>1</td>
<td>5.0</td>
</tr>
<tr>
<td>Some high school</td>
<td>1</td>
<td>5.0</td>
</tr>
<tr>
<td>High school graduate</td>
<td>1</td>
<td>5.0</td>
</tr>
<tr>
<td>Some college</td>
<td>8</td>
<td>40.0</td>
</tr>
<tr>
<td>College graduate</td>
<td>7</td>
<td>5.0</td>
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<tr>
<td>Graduate/professional</td>
<td>2</td>
<td>10.0</td>
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<tr>
<td><strong>Employed</strong></td>
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</tr>
<tr>
<td>Yes</td>
<td>6</td>
<td>30.0</td>
</tr>
<tr>
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<td>14</td>
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</tr>
<tr>
<td><strong>Income</strong></td>
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<tr>
<td>Less than $10K</td>
<td>9</td>
<td>45.0</td>
</tr>
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<td>$10,001 - $25K</td>
<td>4</td>
<td>20.0</td>
</tr>
<tr>
<td>$25,001 - $75K</td>
<td>5</td>
<td>25.0</td>
</tr>
<tr>
<td>$75,001 - $100K+</td>
<td>2</td>
<td>10.0</td>
</tr>
</tbody>
</table>
Treatment

Participants in the study were treatment seeking women who received trauma-focused individual psychotherapy at the CTSTS. The mean number of psychotherapy sessions for follow-up study participants was 9 sessions. Treatments included, but were not limited to, cognitive behavioral therapy, Cognitive Processing Therapy (CPT; Resick, Monson, & Chard, 2007), and Prolonged Exposure Therapy (PE; Foa, Hearst, Dancu, Hembree & Jaycox, 1994).

Procedures

When individuals seek treatment from the CTSTS they go through an intake process, which consists of intake interview with a therapist and self-report paperwork that includes a research interest form. If an individual consented to participate in research, they were contacted by the investigator and an appointment was arranged for informed consent and the baseline assessment. This appointment often was scheduled before or after a therapy appointment or at another time at the patient’s convenience. The baseline assessment was conducted as soon as possible after the initial intake appointment. The majority of baseline assessments were completed within 7-10 days following the intake assessment.

At the scheduled appointment, participants provided informed consent. Participants then completed a neuropsychological battery focusing on executive
function tasks. This test battery was brief (25-30 minutes) and was administered by the researcher (Kristen Walter, M. A.) in a private research office room in the CTSTS. Following the neuropsychological battery, participants then completed a 30-35 minute self-report questionnaire packet in the same private research office. Upon completion of the baseline appointment, participants received $10 in payment.

Three months after the initial baseline assessment, participants were contacted to complete the 3-month follow-up assessment. This assessment was identical to the baseline. Participants received an additional $10 for the 3-month follow-up and were thanked for their participation in the study. The 3-month time frame was designed to allow for the potential completion of at least 10 sessions of PE, 12 sessions of CPT or 12 sessions of non-manualized trauma-focused treatment.

**Measures**

Study 2 used both self-report and investigator administered neuropsychological instruments. For the current study, demographics, PTSD symptoms, anxiety symptoms, depression symptoms, previous trauma history, alcohol/drug/cigarette use, sleep quality, self-control, and neuropsychological assessments measuring executive functioning were gathered at baseline and at the 3-month follow-up assessment. The assessment required 30-35 minutes of participants completing self-report measures and an additional 20-25 minutes
completing executive function tests with the investigator. Thus, each assessment was approximately one hour in duration. All measures were administered at both assessment time points for the follow-up study participants. The baseline-only participants completed only the initial assessment.

**Self-report Measures**

*Demographics.* Participants provided limited demographic information including age, race, education, employment status, annual income, brief medical history, and current prescription use.

*Post-Traumatic Symptom Scale - Self-report (PSS-SR; Foa, Riggs, Dancu & Rothbaum, 1993).* The PSS-SR is a frequently used 17-item scale that contains items which correspond to PTSD symptom criteria found in the *Diagnostic and Statistical Manual of Mental Disorders, fourth edition, revised (DSM-IV-TR; American Psychiatric Association, 2000).* Each of the 17 items on the PSS corresponds to a symptom of PTSD listed in the DSM-IV-TR criteria for PTSD. Each symptom criterion is rated in terms of frequency or severity on a 0 (not at all) to 3 (very much) scale. Higher scores represent more severe and frequent PTSD symptoms. The Cronbach’s alpha for the PSS ranges from $\alpha = .65 - .86$ (Foa & Tonlin, 2000).

*Brief Self-Control Scale (BSCS; Tangney, Baumeister & Boone, 2004).* The BSCS is a recently developed self-report scale assessing individual differences concerning the construct of self-control. The brief version of the SCS
will be used in this study. Thirteen items are rated on a likert scale anchored from 1 (not at all like me) to 5 (very much like me). Higher scores reflect higher self-control. Internal consistency for this measure is approximately $\alpha=.85$ and test-retest reliability was also $r=.87$ (Tangney et al., 2004). The brief version correlates approximately $r=.93$ with the full scale in developmental studies (Tangney et al., 2004).

**Beck Depression Inventory (BDI; Beck, Ward, Mendelson, Mock & Erbaugh, 1961).** The BDI is a commonly used self-report inventory designed to measure attitudes and symptoms of depression. The BDI consists of twenty-one questions and respondents select the statement that best reflects how they are feeling in the past week. Answers on the BDI range from 0 (not endorsing the item in the past week) to 4 (endorsing a more severe expression of the item in the past week). BDI total scores can range from 0-63, with scores above 19 suggesting above a moderate level of depression. Internal consistency for the BDI is $\alpha=.86$ (Beck, Steer & Garbin, 1988) and test-retest reliability ranges from $r=.48-.86$, depending on the interval and population under examination (Groth-Marnatt, 1990).

**Trauma History Questionnaire (THQ: Green, 1996).** The THQ is a 24-item self-report measure that assesses a wide range of traumatic events that participants may have experienced. The measure contains questions related to crime, natural disaster, sexual and physical abuse, and combat exposure. The participant responds “yes” or “no” to each item on the measure. If the participant
responds “yes” to a given question then they are asked to report how many times the traumatic event occurred and the approximate age when they experienced the event. The THQ will be used in this study at baseline to measure previous trauma history and at the 3-month follow-up to determine trauma exposure over the course of the study.

*Drug Abuse Screening Test-10 (DAST-10; Skinner, 1982).* The DAST-10 is a brief, self-report instrument intended to assess the severity of problems related to drug abuse over the past 12 months. Participants respond either “yes” or “no” to the 10 items on the instrument as they relate to drug use, but not alcohol use. The 10 item version of the DAST-10 will be used in the study and correlates highly (r=.98) with the DAST-20. The DAST-10 is scored on a scale from 0-10, with yes responses keyed to equal one point. A score of 1-2 is interpreted as having low levels of problems, scores of 3-5 indicate intermediate/likely DSM criteria, scores of 6-8 imply substantial drug problems and scores of 9-10 suggest severe problems with drug use.

*Alcohol Use Disorders Screening Test (AUDIT; Saunders et al., 1993).* The AUDIT is a widely used 10-item self-report questionnaire that assesses domains of drinking behavior, alcohol consumption, and alcohol-related problems in order to screen for hazardous alcohol use. Responses are scored from 0 to 4, with a maximum score of 40 for the instrument. An AUDIT score of 8 has been shown to distinguish hazardous from non-hazardous alcohol users.
Cigarette-use questionnaire. Three questions assessing the participant’s past and current cigarette use are also included in the self-report measures.

Pittsburgh Sleep Quality Index (PSQI; Buysse, Reynolds, Monk, Berman & Kupfer, 1989). The PSQI is a self-report index which assesses sleep quality and patterns over a one-month period. Nineteen questions measure 7 areas of sleep including sleep latency, subjective sleep quality, sleep disturbances, sleep duration, use of sleep medication, habitual sleep efficiency and daytime dysfunctions. Answers on the PSQI range from 0 (no or minimal symptoms evident on item) to 3 (severe symptoms present). The sum of scores from the 7 areas yields one global score. A global sum score of 5 or greater indicates a “poor” sleeper. Internal consistency and reliability for the PSQI is α=.83 and r=.83, respectively (Buysse et al., 1989).

Stait-Trait Anxiety Inventory (STAI; Spielberger, Gorsuch, & Lushene, 1970). The STAI is a self-report measure designed to assess state and trait anxiety in adults. The STAI-state scale measures anxiety in relation to current situations and stress, while the STAI-trait scale assesses stable individual differences in anxiety. The STAI state and trait scales each consist of 20 items for a total of 40 items in the measure. Items are rated from “not at all” to “very much so” depending on how accurately the individual believes the item describes them. Higher scores on the STAI reflect higher levels of anxiety. Approximately half of the items on each scale are reverse-coded. The STAI-trait scale produced
reliability coefficients of $r=.65-.86$ and the STAI-state scale showed reliability of $r=.16-.62$.

**Clinician-Administered Neuropsychological Assessment Measures**

*American Version of the Nelson Adult Reading Test (AVNART; Nelson, 1982).* The AVNART is a commonly used neuropsychological measure to assess premorbid intelligence. In this test, participants are asked to read and pronounce 45 words that do not follow typical rules of pronunciation. Higher scores on the AVNART suggest higher verbal premorbid intelligence.

*The Boston Qualitative Scoring System for the Rey-Osterrieth Complex Figure (BQSS; Stern et al., 1994).* The BQSS is a comprehensive scoring system for the Rey-O Complex Figure task and assesses visual memory, visuospatial organization, and executive function. Three conditions are administered during the task, which include copy, immediate recall, and a 20 minute delayed recall. During the task, participants are asked to copy and recall a complex geometric figure. As they draw the figure they are asked to switch the colored markers they are using, which are handed to them by the test administrator. The use of colored markers when drawing the complex geometric figure allows for specific scoring of presence, accuracy, placement, and fragmentation. Raw scores are then converted to summary scores, allowing for indices of visual memory, visuospatial organization, and executive function.
Delis-Kaplan Executive Function System Trail Making Test (D-KEFS; Delis, Kaplan, & Kramer, 2001). The TMT available in the D-KEFS assessment package is used to measure temporal sequencing and mental flexibility.

Condition 1 of the TMT asks participants to visually scan circles containing letters and numbers and to cross out the number “3” each time they see the number. Condition 2 asks participants to only connect numbers among circles containing letters and numbers. Condition 3 asks participants to only connect letters among circles containing letters and numbers. Condition 4 of asks the participant to connect numbers and letters in an alternating pattern (e.g. 1-A-2-B-3-C, etc.) as quickly as possible. The final task, condition 5 asks participants to connect a dotted line from start to finish, allowing for measure of motor function.

Participants are given 150 seconds to complete each condition, except for condition 4, which allows for 240 seconds. Performance is recorded in the seconds it takes for a participant to complete the task, including the correction of errors. Numbers of errors made during test administration is also noted.

Subtracting abilities such as motor function and visual tracking allows for more pure measurement of executive abilities.

Stroop Color and Word Test (Stroop, 1935). The Stroop Color and Word Test is a well known neuropsychological test that measures executive functions of inhibition and cognitive flexibility. The test relies on the relative cognitive strength in humans of reading words as compared to naming colors. For example it is easier for an individual to read the word “red” than it is to identify
red ink in a word that reads “green.” The Stroop Color and Word Test consists of 3 forms including a word page with color names written in black ink, a color page with XXXXs printed in color ink, and a color-word page with color names written in colored ink different than the color name (e.g. BLUE is printed in green ink). The participant is first asked to read the color names on the first form, they are then asked to identify the color of ink in the second form, and then finally they are asked to identify the color of ink, and not read the color name, used in the third form. The participant is asked to complete as much of each of the 3 tasks in 45 seconds per task. The number of correct responses is used to obtain T-scores revealing the participant’s performance.

Results

The executive function dependent variables, D-KEFS number-letter sequencing (time to completion), D-KEFS number-letter sequencing errors (number of errors), and the Stroop color-word score (number of colors correctly identified in 45 seconds) were calculated as raw scores according to instructions provided by their respective manuals. The BQSS organization raw scores were converted to summary score following the instructions in the manual (D-KEFS; Delis, Kaplan, & Kramer, 2001). The psychological dependent variables, PTSD symptoms, depression symptoms, state/trait anxiety, and self-control were scored following the scoring procedure recommended for each measure. Means and standard deviations can be found in Table 2-3. Results of analyses allude to
change in executive function and psychological symptoms over 3 months of trauma-focused treatment.

Table 2-3. Means and Standard Deviations for Study Variables (n = 20)

<table>
<thead>
<tr>
<th></th>
<th>Baseline M (SD)</th>
<th>3-month M (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Executive Function Measures</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D-KEFS number-letter sequencing</td>
<td>92.17 (47.52)</td>
<td>89.45 (49.53)</td>
</tr>
<tr>
<td>D-KEFS number-letter sequencing errors</td>
<td>.60 (.73)</td>
<td>1.07 (1.58)</td>
</tr>
<tr>
<td>BQSS organization</td>
<td>5.20 (1.42)</td>
<td>5.20 (1.52)</td>
</tr>
<tr>
<td>Stroop color-word score</td>
<td>33.20 (12.59)</td>
<td>36.33 (10.95)</td>
</tr>
<tr>
<td><strong>Psychological Measures</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PTSD</td>
<td>35.57 (7.92)</td>
<td>22.21 (13.59)</td>
</tr>
<tr>
<td>Depression</td>
<td>31.21 (11.36)</td>
<td>17.28 (12.92)</td>
</tr>
<tr>
<td>State anxiety</td>
<td>39.36 (4.93)</td>
<td>28.86 (15.17)</td>
</tr>
<tr>
<td>Trait anxiety</td>
<td>42.43 (7.90)</td>
<td>33.57 (14.30)</td>
</tr>
</tbody>
</table>

Repeated measures MANOVA was used to test the hypotheses that (1) executive function performance and (2) PTSD and other psychological symptoms would change following 3 months of trauma-focused treatment. A repeated measures ANOVA was also used to determine if self-control changed over the course of trauma-focused treatment. Variables in the equation met the following assumptions for the analysis: variables were normally distributed (both univariate and multivariate normality), variables were not multicollinear, linear relationships
existed among variables, observations were independent, and time between assessments was equal among study participants.

Completer Analyses. Twenty women participated in the follow-up study and 15 completed both baseline and 3-month follow-up assessments. Fifteen of 20 participants who completed the follow-up resulted in a retention rate of 75%. Completers and non-completers did not differ on demographic variables such as: age $t(18) = .65, p>.05, ns$; education $t(18) = -1.46, p>.05, ns$; annual income $t(18) = 1.24, p>.05, ns$; or race $t(18) = 1.42, p>.05, ns$. The groups did not differ on estimated IQ $t(18) = .24, p>.05, ns$; or baseline PTSD symptoms $t(18) = -1.78, p>.05, ns$. There were also no significant differences on any of the executive function measures between completers and non-completers D-KEFS trails letter-number sequencing $t(18) = -1.20, p>.05, ns$; D-KEFS trails letter-number sequencing error $t(18) = .08, p>.05, ns$; BQSS organization score $t(18) = .45, p>.05, ns$; or Stroop color-word score symptoms $t(18) = 1.44, p>.05, ns$. The only significant differences between completers and non-completers on any variables were baseline alcohol use (AUDIT) scores and the number of therapy sessions received at the CTSTS. Specifically, individuals who did not complete both assessments had higher use and misuse of alcohol ($M=9.20; SD=9.80$) than those who did complete both assessments ($M=1.47; SD=2.92$). Also, individuals who did not complete the 3-month assessment had fewer sessions ($M=3.33; SD=1.53$) than those who did complete the 3-month assessment ($M=9.87, SD=1.51$).
PTSD and Impairment in Cognitive Performance. Distributions were run to determine the frequency of impairment on cognitive measures among women with PTSD, see Table 2-4. In a normal distribution it would be expected that approximately 16% would score at or below 1 standard deviation from the mean and 7% would be at or below 1.5 standard deviations from the mean.

Table 2-4. Percentage of Sample who Performed at Impaired Levels on Executive Function Measures (n=32).

<table>
<thead>
<tr>
<th>Test</th>
<th>% 1 SD below mean</th>
<th>% 1.5 SD below mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stroop</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Color-word</td>
<td>37.5</td>
<td>15.6</td>
</tr>
<tr>
<td>D-KEFS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trails 4</td>
<td>21.9</td>
<td>15.6</td>
</tr>
<tr>
<td>Errors on Trails 4</td>
<td>6.3</td>
<td>6.3</td>
</tr>
<tr>
<td>BQSS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Organization</td>
<td>25.0</td>
<td>15.6</td>
</tr>
</tbody>
</table>

As shown in Table 2-4, the prevalence of impairment in this sample of PTSD patients is consistently higher than would be expected in the general population. The frequency of impairment was greatest on the Stroop task, with 37.5% of the sample performing at or below 1 SD from the mean on the color-word task. Overall, individuals with PTSD do show impairment on several cognitive tasks at a frequency higher than expected in a normal distribution.
Change in Executive Function Performance. A repeated measures MANOVA was conducted to investigate whether executive function performance improved over the course of 3 months of trauma-focused treatment. The dependent variables in this analysis were performance on 4 measures of executive function (D-KEFS number-letter sequencing, D-KEFS number-letter sequencing errors, BQSS organization, and Stroop color-word score). There were no between-subjects variables in this analysis. Due to limited power and lack of consistently related covariates, the analyses were run without the use of covariates.

The multivariate F test (using Wilks’ Lambda) indicated a linear trend for improved executive function performance over the course of trauma-focused treatment, $F(4,11) = 2.81, p = .078$. Examination of univariate analyses, however, revealed a significant change in the Stroop color-word score over the course of trauma-focused treatment $F(1,14) = 10.98, p < .01, d = .87$, in that performance improved at the 3-month follow-up as compared to performance at baseline. Repeated measures MANCOVA results revealed that performance on 1 of the 4 measures of executive function significantly changed over the course of trauma-focused treatment.

Change in Psychological Symptoms. A repeated measures MANOVA was also conducted to investigate whether PTSD and other psychological symptoms improved over the course of 3 months of trauma-focused treatment. The
dependent variables in the second analysis were psychological symptoms (PSS-SR score, BDI score, STAIS score, and STAIT score). There were no between-subjects variables in this analysis. Again, due to limited power and lack of consistently related covariates, the analyses were run without covariates.

The multivariate F test (using Wilks' Lambda) indicated a significant omnibus effect for improvement in psychological symptoms over the course of trauma-focused treatment, $F(4, 10) = 4.66$, $p<.05$, $d=.79$. Examination of univariate analyses indicated a significant change in all 4 of the psychological symptom measures. PTSD symptoms, as measured by the PSS-SR, improved over the course of treatment $F(1,14) = 19.93$, $p<.001$, $d=.98$. Specifically, PTSD symptoms improved at 3-month follow-up as compared to baseline. Depression symptoms also decreased from baseline to 3-month follow-up $F(1,14) = 15.84$, $p<.01$, $d=.96$. There were also a reduction in state anxiety over time $F(1,14) = 8.03$, $p<.01$, $d=.74$. Although measurement of trait anxiety should result in consistent reports of anxiety, trait anxiety also improved over the course of treatment $F(1,14) = 11.94$, $p<.01$, $d=.89$. Results of the repeated measures MANOVA showed that after 3 months of trauma-focused treatment participants reported fewer symptoms of PTSD, depression, state anxiety, and trait anxiety.

Change in Self-control. A repeated measures ANOVA was conducted to determine if self-control changes over the course of trauma-focused treatment. The dependent variable in the analysis was self-control, as measured by the BSCS. No between subjects factors or covariates were used in the analysis. The
multivariate F test (using Wilks’ Lambda) did not indicate a significant change in self-control from baseline to 3-month follow-up, F (1,13) = .22, p>.05, d=.07. Repeated measures ANOVA results showed that self-control did not change over the course of trauma-focused treatment.

Correlations between Self-control and Measures of Executive Function.

Bivariate Pearson correlations were used to determine the association between self-reported self-control and tests of executive function. More specifically, it was expected that greater self-control would be related to better performance on executive function measures. Bivariate correlations between self-control and executive function measures can be found in Table 2-5.

Table 2-5. Bivariate Correlations between Baseline Self-control and Baseline Measures of Executive Function (n=32).

<table>
<thead>
<tr>
<th>Baseline self-control</th>
<th>r</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stroop color-word score</td>
<td>-.28</td>
</tr>
<tr>
<td>BQSS organization score</td>
<td>-.65**</td>
</tr>
<tr>
<td>D-KEFS number-letter sequencing</td>
<td>.20</td>
</tr>
<tr>
<td>D-KEFS number-letter errors</td>
<td>.04</td>
</tr>
</tbody>
</table>

Note. **p<.01

Results showed that baseline self-reported self-control was strongly associated with the baseline BQSS organization score. However, the pattern of the association runs counter to expectations, as higher self-control was related to lower BQSS organization scores. No other significant correlations emerged.
Discussion

Findings from the current study contribute to knowledge regarding the nature of executive function, PTSD symptoms, and self-control over the course of 3 months of trauma-focused treatment. Results showed that 1 of the 4 measures of executive function improved over the course of trauma-focused treatment, during which time psychological symptoms in multiple areas also improved. Finally, although self-control did not change over the course of trauma-focused treatment, it was significantly related to performance on a measure of executive function.

It was found that only the Stroop color-word score, one of the measures of executive function, significantly improved from baseline to 3-month follow-up. Study hypotheses predicted performance on all 4 measures of executive function would improve over the course of the study; however, there are reasons why changes were observed on just one test. The Stroop color-word score is considered to be a strong measure of cognitive inhibition, and it is possible that inhibition is particularly important in PTSD. Persons with PTSD often exhibit difficulties in inhibiting responses or even acting impulsively, as evidenced by the elevated rates of substance use (Brown, Fulton, Wilkeson, & Petty, 2000; Friedman, 1990), self-harm (Boudewyn & Liem, 1995), and aggressive behavior (Dileo et al., 2008). Past studies examining executive function in PTSD are inconsistent (Koenen et al., 2001), so failing to find treatment-related improvements in planning/organization (DKEFS errors, BQSS organization) or
set-shifting (DKEFS sequencing) is not uncommon. However, it is important to note that relatively high rates of cognitive dysfunction were observed on all measures of executive function. Replication in a larger sample is much needed.

Another study finding is that psychological symptoms improved over the course of trauma-focused treatment. The study was primarily interested in the change in PTSD symptoms, but also investigated the change in depression and anxiety symptoms as they are often comorbid conditions with PTSD. Symptoms of PTSD, depression, state, and even trait anxiety significantly improved through trauma-focused treatment. This raises a question about the nature of trait anxiety as measured by the STAI-trait that perhaps the scale captures a more transient expression of anxiety, similar to the state measure. It is also possible that participants respond in a manner that is consistent with their current level of anxiety.

The final analyses conducted in the study explored whether self-reported self-control changed from baseline to 3-month follow-up and whether self-control related to measures of executive function. Repeated measures ANOVA results revealed that self-reported self-control did not change over the course of trauma-focused treatment; rather the reported levels appeared to be similar between the two time points. This finding is not entirely surprising as self-control was measured by the BSCS, which is a trait measure of self-control (Tangney, Baumeister & Boone, 2004). Thus, individuals’ perception of their self-control
appears to be unchanged over the course of trauma-focused treatment. Use of state-like measures of self control may yield different findings.

Bivariate correlations between self-reported self-control and measures of executive-function were also run to determine the strength of relationship between the variables. Correlation results revealed that self-reported self-control at baseline was significantly related to the BQSS organization score. However, the significant correlation between self-control and BQSS organization score was in the negative direction – indicating that individuals higher on self-control have lower BQSS organization scores, which is counter to study hypotheses. The reason for this unexpected finding is unclear. One possibility is that study participants are inaccurate in their self-report. Studies have supported the hypothesis that individuals do not always accurately report neuropsychological deficits (Lindem et al., 2003) and self report may show a similar pattern. Given the nature of cognitive dysfunction in the current sample, it is likely that individuals may have difficulties in accurate self monitoring and awareness. Another possibility stems from the multifaceted nature of self-control. The construct of self-control may be comprised of numerous related abilities that are not entirely assessed by the neuropsychological measures employed in the current study and it is possible that a behavioral measure of self-control may show different correlations to executive functioning. Taken together, these findings show that executive function can change over the course of treatment for PTSD. Furthermore, psychological symptoms also changed from baseline to 3-
month follow-up, providing a potential pathway for increased neuropsychological function. It should be noted that both executive function performance and self-reported psychological symptoms were measured at only two time points, so investigating if one factor contributed to improvement in the other was not examined, but is an important question for future studies to consider. Significant improvement shown in one of the measures in a small size provides encouraging results for a larger scale study examining change in executive function over the course of trauma-focused treatment.

The current study has numerous strengths that further knowledge regarding the neurocognitive consequences of PTSD. To my knowledge, no study has examined change in executive function over time in sample of treatment-seeking individuals with PTSD. Executive function abilities are critical for purposive behavior, working independently, and engaging in social behavior (Lezak, Howieson, & Loring, 2004, p. 35). Researching the nature of executive function in individuals with PTSD and the possibility of improving executive function is an important endeavor for clinical and neuropsychological research. Symptom reduction is a vital outcome of trauma-focused treatment, however, facilitating other outcomes such as executive function improvement, can also impact the lives of patients receiving treatment for PTSD.

This study also tried to improve upon previous research methods used in neuropsychological studies. One improvement was the multi-method data
collection process. Since participants received treatment at a research-based treatment setting, data collection included self-report measures, neuropsychological measures, and clinician-administered measures. The study also used a community sample of treatment-seeking women receiving psychological treatment for PTSD. The study was comprised of a fairly homogenous sample, allowing for less variability in other factors that may contribute to differences in executive function performance (e.g. head injury, gender). Additionally, this study prospectively examined participant’s executive function performance and psychological symptoms. The 3-month follow-up was designed to allow for a sufficient dose of intervention/treatment to reveal effects in the outcome measures. A longitudinal design allows for the assessment of change in neuropsychological performance over the course of treatment for PTSD and is critical to further our understanding about the nature of executive function performance.

Limitations of the study include a small sample size, precluding the possibility of using more advanced statistical techniques or adding variables to make a more comprehensive model. There are a number of factors that can affect both PTSD and neuropsychological performance. Use of an advanced statistical technique or adding control variables would likely provide a more comprehensive analysis of the proposed hypothesis. Also, it is possible that significant changes in the D-KEFS number-letter sequencing, D-KEFS number-letter sequencing errors, and BQSS organization score would be detected if they
did reflect changes in time among participants. Further, although the results are
generalizable to females receiving treatment for PTSD, the results may not apply
to other samples of PTSD patients (e.g. combat veterans, those with LOC for
greater than 10 minutes). However, impairments on executive function tasks
have been inconsistent between different samples of trauma-exposed individuals
(Koenen et al., 2001), so a fairly homogenous sample was designed to be used
for this particular study. The study did not use a control group. A control group
would show whether changes in executive function were due to treatment or to
naturalistic improvement. A larger scale study examining the longitudinal nature
of executive function should add a control group for this reason. Lastly, the
person scoring the assessments was not blind to knowing whether the
assessment was a baseline or follow-up assessment. Although this aspect did
not appear to influence results, a larger scale study examining these effects
should improve on this limitation.

The study intended to help clarify the conflicting results in the literature
examining the relationship between PTSD and impairment on executive function
tasks. Given that many studies have shown some executive function impairment
in individuals with PTSD (Gil et al., 1990; Sutker et al., 1991; Uddo et al. 1993;
Bremner et al., 1993, 1995; Beckham et al., 1998; Vasterling et al., 1998, 2002;
Yehuda et al., 1995; Jenkins et al., 2000; Koso & Hansen, 2006) it was theorized
that individuals with PTSD would experience an increase in executive function
over the course of trauma-focused treatment, as theoretically, the symptoms of
PTSD would also be reduced. Results of the study indicated that improvement in executive function performance was evident on a neuropsychological task measuring inhibition. These findings are encouraging, particularly because the effect was powerful enough to be detected in a small sample size. Conducting a longitudinal study examining executive function performance over the course of trauma-focused treatment with a larger sample will allow for increased power to detect other possible effects. However, as one of the first studies examining executive function change over the course of trauma-focused treatment, results suggest that executive function performance may improve though psychological treatment, providing additional positive outcomes for patients receiving services for PTSD.
GENERAL DISCUSSION

The aim of these two studies was to examine how self-control and executive function relate to PTSD symptoms and how they change over time. These studies contribute to the literature by bridging two fields of study to explore how self-control and PTSD relate and being the first to examine if executive function changes over the course of trauma-focused treatment. Specifically, study 1 revealed that self-control predicted later PTSD symptoms; however, PTSD symptoms did not appear to predict later self-control. Study 2 showed that executive function can improve over the course of treatment for PTSD, suggesting additional treatment outcome gains beyond psychological symptom alleviation. Taken together, these studies suggest that abilities necessary for successful daily functioning (self-control, inhibition) can buffer against future PTSD symptoms and change through PTSD treatment. This allows for improvement in both symptom reduction and in daily function.

Self-control is critical for an individual to obtain long-term goals that are in their best interest. In order to execute the self-control that is required to attain these goals, executive function abilities such as impulse control, planning, reasoning and affection regulation must be implemented. These abilities are
often impaired in individuals with PTSD, creating further difficulties with daily living and in coping with symptoms of the disorder. The relationship among these variables appears to be circular in nature. If individuals can attain sufficient levels of self-control then they may be better able to persist through psychological treatment, which in turn may improve executive function, leading to enhanced self-control. By bolstering self-control resources an individual may be able to attain symptom reduction. Furthermore, if individuals are in trauma-focused treatment, they may also experience executive function improvement, revealing an additional positive outcome for these individuals.
REFERENCES


Empowering survivors of abuse: Health care for battered women and their children. (pp. 195-203).


